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ABSTRACT

In order to assess the degree to which learning is taking place in a particular school, it is necessary that the desired outcomes the school is trying to develop in its students be translated into clearly-defined performance objectives. These objectives then can become the basis upon which curriculum decisions can be made. This study's purpose was to evaluate a performance objective-based high school chemistry program. The evaluation was based on cognitive achievement and attitude toward chemistry developed as a result of being enrolled in this program. Seven sections of chemistry, taught by four teachers, were involved in the study. Students were randomly assigned to two treatment groups: (1) teachers taught directly from the stated objectives, students were given a copy of the objectives for each instructional unit, activities and experiments were geared for the accomplishment of the stated objectives; and (2) teachers agreed on the validity of the objectives but taught in the same manner as in previous years, with students receiving no copies of the objectives. Data on student achievement in this one-semester study were obtained from four achievement instruments developed by the teachers. Students' attitudes were measured by the Attitudes Towards any School Subject developed by Silance and Remmers. A groups-within-treatments design was used for data analysis. The objective-based curriculum in chemistry appeared to have a significant effect upon student achievement as well as a significant effect upon student attitudes towards chemistry. (Author/PEB)

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AN ANALYSIS OF AN OBJECTIVE-BASED CURRICULUM IN CHEMISTRY

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ANALYSIS OF AN OBJECTIVE-BASED CURRICULUM IN CHEMISTRY

INTRODUCTION

If one looks at our schools, the students, the teachers and the activities that go on in them, it seems quite evident that the main function of the schools is to facilitate learning. The degree to which a school can facilitate learning can then be a measure of the quality of that institution.

To assess the degree to which learning is taking place in a particular school, it is necessary for the school to have translated the desired outcomes it is trying to develop in its students into clearly-defined performance objectives. These objectives then become the basis upon which decisions about the various parts of the school and its curriculum are made. Experience seems to indicate that unless a school translates its objectives into clearly-stated operational definitives, little is likely to be done about them or information about the degree at which these objectives are being accomplished cannot be compiled. Systematic evaluation is non-existent.

It becomes fairly obvious that a school should undertake a program clearly defining and specifying their objectives. Some of the benefits of an objective-based curriculum are:

1. Specification of objectives should lead to greater clarity in the direction of classroom instruction.

2. The specifying of objectives lets the pupil know what is expected of him and what performance will be accepted as evidence of mastery.

3. Once an objective is specified, it may be evaluated in terms of its potential contribution to achieving the goals of the total educational program.

4. Clearly stated objectives often suggest appropriate classroom activities. The lack of objective specification often shifts the emphasis to the activity rather than the purpose for which it was designed.

5. Innovative programs can be evaluated by using specified objectives as criteria. Suggested learning activities and evaluative instruments or procedures can be approved in terms of their relationship to the stated goals.

6. More meaningful reporting of pupil progress to parents can be attained by indicating which objectives have been mastered by the pupil and which have not.

An objective based curriculum was developed by four chemistry teachers at Deerfield and Highland Park High schools and implemented into the total program during the 1972-73 academic year. This report is based on a study of this objective based curriculum and concerns itself with its effect on achievement and attitude towards chemistry.

DESIGN OF THE STUDY

A. Organization

The population for this study consisted of all students enrolled in chemistry at Deerfield High School. The students taking chemistry were divided into two treatment groups. The first group was given a list of all performance objectives necessary for mastery in chemistry. The second group was taught in the same manner as in previous years. There were seven sections of chemistry and four teachers taking part in this study.

The teachers were randomly assigned to treatment groups.

The performance objectives used for this chemistry course were developed by a group of District 113 chemistry teachers during the summer of 1972.

The study was conducted during the first semester of the 1972-73 academic year.

B. Analysis of Data

All statistical data obtained from properly controlled instruments displays a variation about a mean score. The problem is to parcel out the variations due to measurement error and those due to treatment effects. Then if the main factors account for systematic differences in mean scores, we must be able to see through the random errors to infer the existence of main effect differences in mean scores. The statistical techniques for performance of this kind of analysis is called analysis of variance.

In this study, because intact class had to be used, a group within treatments analysis of variance was used on all measures employed in the study.

The statistical procedures used will reduce the data to a probability value that statistically significant differences exist between measures recorded for each treatment group. This will provide one with an excellent guide in the decision-making process.

C. Instruments

The instruments used to measure achievement of the students in the two treatment groups were developed by the

chemistry instructors in District 113 and were co-ordinated with the performance objectives developed for the course. Four achievement instruments were used in this study.

The reliability of the achievement instruments were calculated using the Kuder-Richardson Formula-20. The reliability measures in general have a range from 0 to 1. Values approaching 1 are desirable but not necessary for meaningful comparison. The reliability of the achievement instruments are indicated in Table I below and are adequate for this study.

TABLE I

Test	Kuder-Richardson Formula #20
Achievement Test #1	.85
" " #2	.78
" " #3	.83
" " #4	.80

The instruments used to measure any differences in attitudes towards chemistry was the Attitudes Towards any School Subject developed by E.B. Silance and H.H. Remmers. Two equivalent forms were developed and the equivalent forms reliability is .81.

RESULTS OF THE ANALYSIS

The first achievement test was taken by the students in both groups before the objectives were given to the experimental group. This procedure was utilized to distinguish if there was any beginning difference in the levels of the two groups. The results of this analysis is summarized in Table II. The analysis indicates that there is no significant difference in the treatment's main effect with respect to achievement on the first examination.

The results of the analysis of variance for the second achievement test is summarized in Table III. This analysis was carried out after students in the experimental group were given the objectives for the course. These students were then able to relate the instructional process to these objectives. The results of the analysis indicate there is a significant difference in the treatment's main effect. The experimental group performed significantly better than the control group as measured by the second achievement test.

The analysis of the results of the third achievement test is summarized in Table IV. The results of this analysis also indicates that there is a significant difference in the treatment's main effect. The experimental group performed significantly better than the control group with respect to achievement as measured by the third achievement test.

Before instructions began in the fourth unit of study, the students in the control group were given the objectives for the chemistry course. If the objectives were the reason the experi-

TABLE II

Group within Treatments Analysis of Variance for Achievement Test #1

Source	df	SS	MS	F
Treatments	1	0.69	0.69	2.76
Groups within Treatments	5	1.26	.25	
Total	6	1.96		
Experimental Group Mean		21.47		
Control Group Mean		21.79		

TABLE III

Group within Treatments Analysis of Variance for Achievement Test #2

Source	df	SS	MS	F
Treatments	1	2.00	2.00	14.82*
Groups within Treatments	5	.70	.14	
Total	6	2.70		
*Significant at 0.05 level				
Experimental Group Mean		18.01		
Control Group Mean		17.03		

TABLE IV

Group within Treatments Analysis of Variance for Achievement Test #3

Source	df	SS	MS	F
Treatments	1	9.30	9.30	9.21*
Groups within Treatments	5	5.06	1.01	
Total	6	14.36		

*Significant at 0.05 level

Experimental Group Mean 19.61

Control Group Mean 18.49

TABLE V

Group within Treatments Analysis of Variance for Achievement Test #4

Source	df	SS	MS	F
Treatments	1	0.03	0.03	.052
Groups within Treatments	5	2.85	0.57	
Total	6	2.88		

Experimental Group Mean 16.51

Control Group Mean 16.63

mental group performed better with respect to achievement, the two groups should not show any difference after instruction on the fourth unit.

Analysis of the results of the fourth achievement test are summarized in Table V. Results of the analysis indicates there is no significant difference in the treatment's main effect with respect to achievement.

The data collected to measure any differences in attitudes of the students in the experimental group as compared to the students in the control group was collected after instruction was completed for the third unit. This was done so any differences in attitudes of the students in the two groups would be measured before the objectives were given to the control group.

Analysis of the results of the attitude measure is summarized in Table VI. The analysis indicates that the students in the experimental group showed significantly better attitudes towards chemistry than the students in the control group, as measured by the test, Attitudes Towards any School Subject.

TABLE VI

Group within Treatments Analysis of Variance for Attitude Towards any School Subject

Source	df	SS	MS	F
Treatments	1	64.8	64.8	6.35*
Groups within Treatments	5	51.30	10.2	
Total	6			

*Significant at 0.05 level

Experimental Group Mean 80.1

Control Group Mean 72.6

CONCLUSION

On the basis of the data that was gathered within the time-frame of this study, it is clear that the objective-based curriculum in chemistry had a significant effect upon student achievement in chemistry. The analysis also indicates this curriculum has had a significant effect upon the attitudes of students towards chemistry.

We should also consider stating performance objectives in other areas. It seems evident that the stating of specific performance objectives in the various curriculum areas may also increase the student achievement in these areas. The greater clarity and direction it gives both students and teachers is very important in the teaching-learning process.